

forming portion. The bump is formed by electrifying this and plating the hole portion with Au or the like. Therefore, a large-scale plating apparatus and a waste disposal plant of hazardous substances such as cyanides are needed to form the plating bump, and therefore, it is practically impossible to do so in a factory that carries out the ordinary assembly processes.

Moreover, the bump leveling for stabilizing the amount of transfer of the adhesive in an unstable transfer process of transfer such as the transfer of the conductive adhesive becomes unnecessary by comparison with the method of the first prior art, and the leveling device for such a leveling process becomes unnecessary. The above is because it is not required to preliminarily level only the bumps since the bumps are crushed on the electrodes of the board while pressurizing the bumps.

Moreover, if the following method is adopted to the embodiments, bonding of high reliability can also be achieved even when a bump 103 is bonded to the electrode 5 of the circuit board 4 as mounted with a shift. That is, when forming the bump 3 on the IC chip 1, a gold ball 96a is formed by subjecting the gold wire to an electric spark similarly to the wire bonding. Next, a ball 96a of a Φd -Bump of the diameter denoted by 95a is formed, and a bump 103 is formed on the electrode 2 of the IC chip 1 by

supersonic waves and thermocompression-bonding by means of a capillary 193 designed so that a chamfer diameter ϕD denoted by 93a of the capillary 193 whose chamfer angle θC is not greater than 100° becomes one-half to three-fourths the gold ball diameter d -Bump and no flat portion is provided in the portion to be brought in contact with the gold ball 96a of a capillary 193 in terms of tip shape. By using the capillary 193 that has the above-mentioned configuration, an approximately conically tipped bump 103 as shown in Fig. 10B can be formed on the electrode 2 of the IC chip 1. Even when the bump 103 formed by the aforementioned method is mounted on the electrode 5 of the circuit board 4 while being shifted by a dimension Z as shown in Fig. 11C, the bump 103 can partially come in contact with the electrode 5 of the board 4 without fail so long as the shift is not greater than half the outside diameter of the bump 103 since the bump 103 has the approximately conically tipped shape. The so-called base 3g of a width dimension d of the bump 3 partially comes in contact with the electrode in Fig. 11D of the conventional bump 3. However, this contact is mere partial contact, leading to unstable bonding. If this is subjected to a thermal shock test or reflow, the bonded portion becomes open. The present invention can eliminate the above-mentioned unstable bonding and provide the bonding of high

production yield and high reliability.

(2) Bonding of IC chip to circuit board

According to the method of the second prior art, the connection resistance has been depended on the number of conductive particles that exist between the bump and the electrode of the circuit board. However, according to the aforementioned embodiments of the present invention, it is not required to place conductive particles between both the electrodes for the electrical continuity between the IC chip side electrode and the board side electrode, and the bump 3 can be directly connected to the electrode 5 by being pressed against the electrode 5 of the circuit board 4 with a load (for example, a pressure force of not smaller than 20 gf per bump 3) heavier than in the first and second prior art examples without being leveled in the leveling process as an independent process. Therefore, the connection resistance value does not depend on the number of interposed particles, and the connection resistance value can be stably obtained. That is, the conductive particles 10a produce the additional effect that the value of the connection resistance between the electrode 5 located on the board side and the bump 3 located on the IC chip side can be reduced when the conductive particles 10a are placed between the bump 3 and the board electrode 5 in directly bonding the bump 3 to the board electrode 5.